Case of the Quarter

Michael K. Kan

Scripps Memorial Hospital, La Jolla, California

Case History

A 37-year-old woman was referred to the nuclear medicine laboratory for thyroid imaging. Palpation showed the thyroid gland was slightly enlarged and nodular, suggesting the presence of goiter. Twenty min after intravenous injection of 5 mCi of [^{99m}Tc] pertechnetate, scintiscans of the thyroid gland were obtained using a Searle Radiographics Pho-Gamma III HP scintillation camera and a newly installed General Electric Portacamera II-B, for the purpose of comparison. Pinhole collimators, a preset count of 100 K, and 20% windows were used for both cameras. Figure 1A was obtained from the Pho-Gamma III camera in 117 sec, while Fig. 1B was obtained from the Portacamera in 200 sec. The patient was very cooperative; there was no significant movement of the neck during the entire procedure.

What are the possible causes for the difference in the quality of the thyroid scintiscans from the two scintillation cameras?

(1) Better intrinsic resolution of the newer generation scintillation camera.
(2) Degradation of intrinsic resolution from the higher counting rate in the Pho-Gamma III scintillation camera.
(3) Difference in the pinhole size between the two collimators.
(4) Both one and three.
(5) All of the above.

For reprints contact: Michael K. Kan, Dept. of Pathology/Nuclear Medicine, Scripps Memorial Hospital, 9888 Genesee Ave., La Jolla, CA 92037.

Solution and Discussion

The correct answer is four since both one and three contribute to the better resolution of the thyroid scintiscan in Fig. 1B. Recent improvements in electronic components and circuit design have upgraded the intrinsic resolution of scintillation cameras. Although the Polaroid camera attachments undoubtedly have also improved, the quality of the print cannot account for the difference noted. The improved resolution is usually not obvious in routine clinical studies with Tc-99m using parallel-hole or diverging collimators because the collimator is by and large the limiting factor in the overall resolution of an imaging system. Differences in the camera performance are more readily seen when the pinhole collimator is employed. The difference between intrinsic resolutions of the two cameras used in our case study is illustrated (Fig. 2).

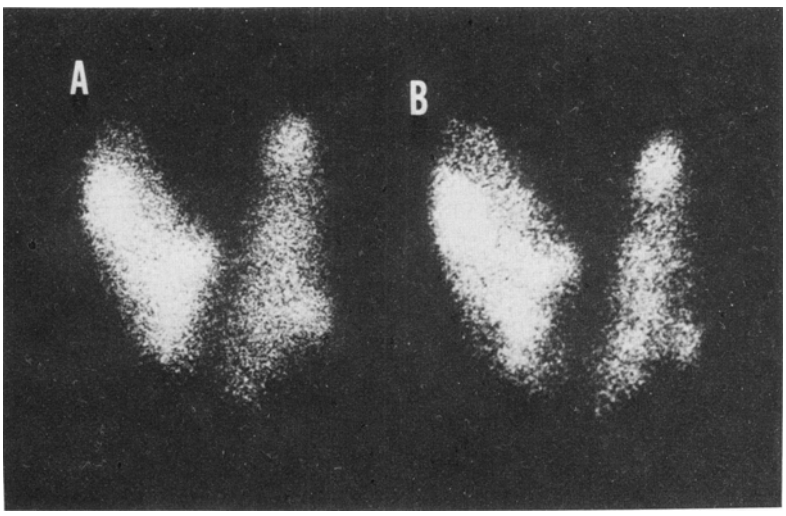

FIG. 1. (A) Anterior scintiscans of the thyroid gland obtained on the Pho-Gamma III HP camera and (B) General Electric Portacamera. Note the difference in resolution.

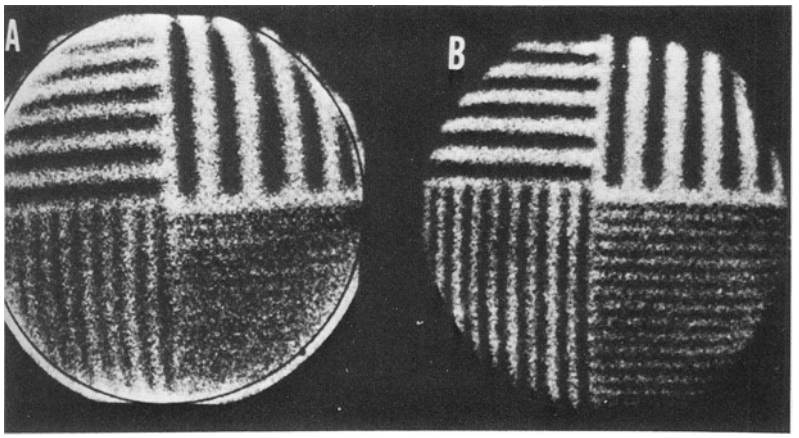

FIG. 2. (A) Comparison of intrinsic resolution of the Pho-Gamma III HP camera and General Electric Portacamera (B) using 20% window and a preset count of 600K. The bar phantom used consisted of alternating lead bars spaced a 1.25 cm, 0.95 cm, and 0.47 cm.

Answer two is wrong because the degradation of intrinsic resolution only occurs at a very high counting rate, not at a counting rate of 1 K per sec, as in our case. The third answer is true because the counting rate was almost two times higher in the Pho-Gamma III scintillation camera in spite of imaging for the same time. A larger pinhole provides a higher counting rate because more gamma photons can pass through the collimator in a given period of time. The larger pinhole, however, degrades the overall resolution of the imaging system. By measurement, the pinhole was 5 mm in diameter on the Pho-Gamma III camera and 3 mm in diameter on the GE Portacamera.